5. Essay on the constitution of the solar system, in which M. Roche attempted to develop the beautiful cosmogonic theory of Laplace, giving precision to certain points and modifying it in others. M. Roche was a Corresponding Member of the Academy of Sciences in the Section of Astronomy, and had been nominated as a candidate for the place vacant by the death of M. Liouville.

THE LATE MR. W. A. FORBES

MR. WILLIAM ALEXANDER FORBES, Fellow of St. John's College, Cambridge, Prosector to the Zoological Society of London, and Lecturer on Comparative Anatomy to Charing Cross Hospital, whose untimely death on the Niger we announced last week, was born at Cheltenham on June 24, 1855, the second son of Mr. J. S. Forbes, the well-known railway director. He was educated at Kensington School and Winchester College, which he entered at the early age of eleven. On leaving Winchester in 1872, Forbes passed a year at Aix-la-Chapelle studying German, and then became a student of the University of Edinburgh, where he pursued the regular medical course, paying special attention to zoology and botany, and commencing collections of insects and plants. In 1875 Forbes transferred his residence to London, and entered himself as a student of London University with the idea of taking a medical degree in the metropolis. Here he became quickly intimate with other zoologists, who were very soon attracted by the astounding general knowledge of zoology and the acute intelligence of one so young. By the advice of the late Prof. Garrod and other friends Mr. Forbes was induced in October, 1876, to leave London and to become an undergraduate of St. John's College, Cambridge, where he was subsequently elected Scholar, and took his B.A. degree with a First Class in the Natural Sciences Tripos in 1879. The post of Prosector to the Zoological Society of London having become vacant in October, 1879, by the lamented death of Prof. Garrod, Mr. Forbes was appointed (*omnium consensu*) to that office in the January following. Indeed he had been designated by Garrod on his deathbed as his most obvious and proper successor, and had been appointed his literary executor.

Mr. Forbes entered upon the duties of his office with characteristic energy, and during the three following sessions of the Zoological Society brought before the scientific meetings a series of most interesting and valuable communications derived from his studies of the animals that came under his examination. He had a happy knack of putting forward abstruse points of anatomy in an understandable form, and especially directed himself to the muscular structure and voice-organs of birds, in continuation of the researches of his predecessor Garrod on the same subjects. In the summer of 1880 Mr. Forbes made a short excursion to the forests of Pernambuco, Brazil, of which he published an account in the *Ibis* for 1881, and in the following year passed his holiday in the United States, in order to make the acquaintance of his American brethren in science and their collections. In July, 1882, he left England on what promised to be a splendid opportunity of visiting the eastern tropics with every advantage and without much risk. Detained at Shonga—a station some 400 miles up the Niger below Rebba—by the breaking down of his communications, Mr. Forbes fell a victim to dysentery on January 14 last, thus adding another name to the long list of martyrs of science in that deservedly dreaded climate.

Mr. Forbes's published works consist chiefly of papers in the *Proceedings of the Zoological Society* and the *Ibis*, altogether about sixty in number. He was editor of the memorial volume of collected scientific papers of his predecessor Garrod, and just before he left England in July last had finished the last sheets of an excellent memoir on the anatomy of the petrels—since published in the "Zoology of the *Challenger* Expedition." This piece of work was originally undertaken by Garrod, but had been left almost uncommenced at the decease of the latter.

Of Forbes's private qualities as a most efficient and ready fellow-worker, a most charming companion and a most sincere friend, the writer is able to testify, not only from personal experience, but also from the universal regret expressed at the unhappy end of so promising a naturalist. P. L. S.

RECENT INFLUENCE-MACHINES

SEVERAL modified types of influence-machine have recently been brought before the public, and as they are both cheaper and more efficient than the older forms of Töpler, Holtz, and Bertsch, will probably find general acceptance. Of the newer forms, those of Voss and of Wimshurst are illustrated in the accompanying cuts.

In the Voss machine, which may be regarded as a modified Töpler machine, there are two disks of varnished glass, one stationary, the other rotating in front of it on an axis which passes through a central hole through the fixed disk. A pair of pulleys with a strap provide the rapid movement necessary. At the back of the fixed disk are fixed two armatures or inductors of varnished paper, with a narrower central band of tinfoil. These armatures are connected on the right and left respectively with two metal clamps which nip on to the edge of the disk and turn round in front of the front plate, each being provided at this part with a little metallic brush. Upon the front of the rotating plate are fastened six or eight metal buttons at equal intervals. These buttons are touched as they rotate by the metallic brushes. Nearly perpendicular, and in front of the front disk, is a brass rod, which need not be insulated, also furnished with spikes at each end, and with a little metallic brush to touch the buttons of the rotating plate. The action of the machine is as follows:—If a small charge of electricity—say a positive charge—be imparted to one armature—say that on the left—the buttons as they move past will be acted on inductively, and if, while thus under the inductive influence of the positive charge, they are momentarily touched by an uninsulated conductor, they will pass on electrified with a charge of the opposite sign. If the front plate rotates in the clockwise direction, each button as it moves through its highest position towards the right will thus acquire a small negative charge which will be given up on arriving at the right side, the projecting arm conveying the charge to the armature at the back. But as the button passes on downwards it will be influenced inductively by the armature behind it, and when touched by the lower end of the vertical conductor, will assume a positive electrification.

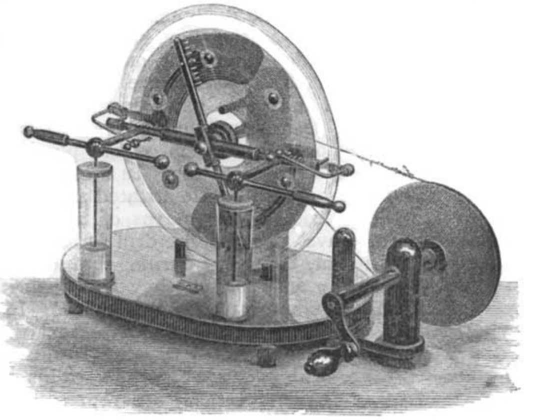

FIG. 1.—Voss's Influence-Machine.

On arriving at the left side it will therefore give up a small positive charge to the left armature, thus charging it more highly than before. Every button as it goes round thus conveys the charges induced in it to the appropriate armatures, and exalts their charge. A very few turns given to the handle suffice to charge those armatures to their fullest extent, so that they begin to discharge pale sparks over the disks. But now begins another action. From right to left in front of the front disk lies an insulating bar of ebonite, holding at each end another brass comb, each connected by a crossbar of brass to the knob of a small Leyden jar. As the charges in the armature rise they act again upon these conductors fixed in front of them, and charge the jars, one positively, the other negatively. A pair of dischargers with ebonite handles serve to discharge the jars when full, and with every turn of the winch, when the knobs of the dischargers are separated by a few centimetres' distance, a torrent of sparks is generated. If the machine is kept free from damp and dust, no initial charge is necessary, as the slight friction of the brushes suffices to give and sustain the requisite preliminary electrification.

Wimshurst's influence-machine is even simpler, and if anything, more efficient. It is the result of a long experimental research carried out with great care and skill by Mr. J. Wimshurst, who is well known as an accomplished amateur electrician. The latest of the many combinations which Mr. Wimshurst has designed is depicted in Fig. 2. It consists of two disks of common window glass mounted upon a common spindle, and provided with driving gear by which an equal speed is given to each, but in opposite directions. Each disk (about fourteen inches in diameter in the smallest size) is well varnished with shellac varnish, and carries twelve narrow strips of thin sheet metal cemented at regular intervals apart. In front, at about 45°, is fixed a diagonal conductor armed at each end with a small brush of metallic bristles, which touch the metal strips as they rotate. At the back a similar diagonal conductor is fixed, exactly at right angles to that in front. Right and left are two upright pillars of glass or ebonite which carry each a pair of metallic combs, and serve also to support the dischargers which are carried in an arch over the disks. It appears that in this machine the metal strips affixed to the plates act both as inductors and as carriers. Suppose, for example, that the front plate is rotating clockwise, and the back plate counter-clockwise. If the metal strips descending from the summit on the left on the back disk are charged positively, the metal strips ascending on the front disk from the left will, as they pass under the momentary touch of the brush, acquire a negative charge. As these negatively charged strips of the front plate advance towards the right they will come to a point where they are opposite the upper end of the hinder diagonal conductor, and here, whilst still acting as carriers to bring the negative charge round to the right side, they will act as inductors, and will influence the strips of the back disk, which will, as they are in turn touched by the hinder brush, acquire positive charges. The strips on the front disk will therefore constantly carry a negative charge as they move over the top from left to right, and those of the back disk will carry a positive charge from right to left. In the lower halves of their respective rotations the inverse of these actions will hold good, the front carriers conveying positive charges from right to left, the back ones conveying negative charges from left to right. The result will of course be that the two main conductors on the left and right will become respectively positively and negatively charged. Theoretically, a small initial charge must be imparted to some one or more of the carriers or to one of the two main conductors. Practically, if dry and free from dust, the machine excites itself, and after a couple of turns

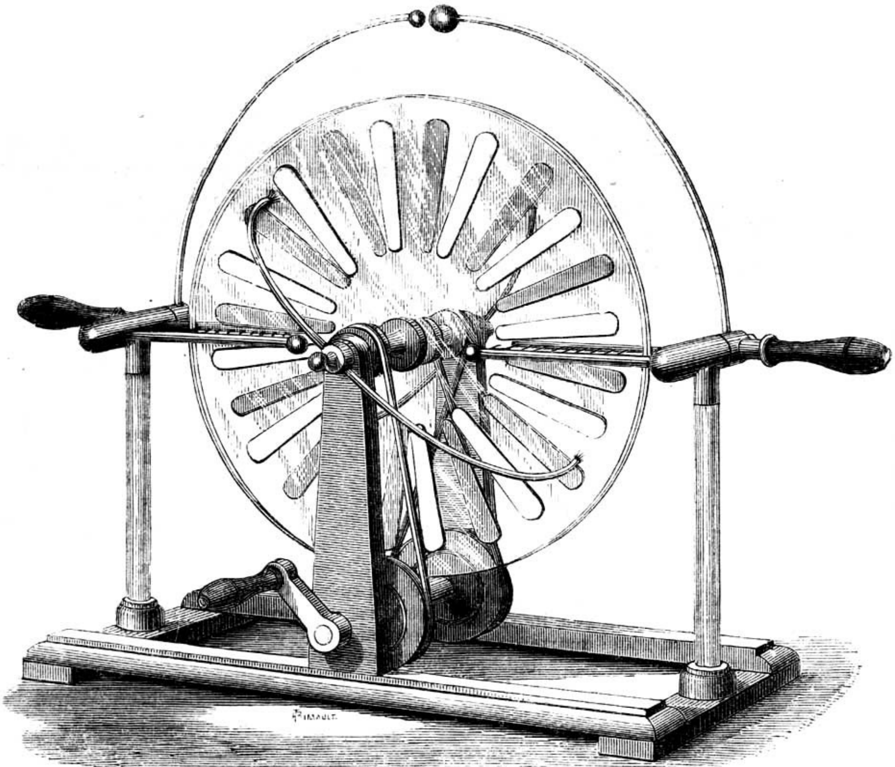

Fig. 2.—Wimshurst's Influence-Machine.

have been given to the handle, discharges sparks freely. If the two main conductors are respectively joined to the inner and outer coatings of a large Leyden jar, the discharges take place with short, loud sparks of great brilliancy. If from any cause the machine does not at once charge itself, a gentle rub with a silk handkerchief on either of the ebonite pillars will suffice to provide the requisite stimulus. The Wimshurst machine appears to be less liable than any other influence-machine to have the polarity of its charge reversed. It serves admirably for the production of the electric shadows discovered by Holtz and Righi. Mr. Wimshurst is much to be congratulated on the service he has rendered to experimental science in devising so useful and efficient an instrument.

THE ZENI NARRATIVE[1]

THERE is no greater puzzle in geographical literature than the so-called "Zeni narrative," which was published at Venice in 1558 by Francesco Marcolini, and claimed to be an authentic compilation by Nicolo Zeno of letters, in the possession of his family, which had been written at the close of the fourteenth century by two of his ancestors, the brothers Antonio and Nicolo Zeno, describing their adventures in the far north.

The story told by Nicolo Zeno was that when a boy he had found these letters in his father's palace, together with a map illustrating the travels of the Zeni brothers, and not knowing their value had torn many of them up. When he grew older he had however learnt to appreciate their true character, for like the rest of his family, one of the most illustrious in Venice, he was an accomplished scholar, and well acquainted with the results of geographical research. And collecting together all the letters that had escaped destruction, he compiled his narrative, and made a copy of the map, supplying from his own knowledge, and his interpretation of the travels of his ancestors, such names and other details as had become illegible from the then half-rotten condition of the original chart.

Ruscelli in 1561, and Moletius, one of the editors of Ramusio, in 1562, followed by the Venetian geographers generally, believed in the authenticity of the Zeni travels, as told by Nicolo the younger, who, as a Member of the Council of Ten, occupied one of the highest posts in the Republic, and was esteemed as a liberal patron of learning. But in other countries doubts were entertained in regard to the truth of the narrative, while in some quarters there arose an utterly untenable notion, that the book had been compiled with the object of securing to Venice the honour of having discovered the New World before Columbus set foot on it. In 1595 the Flemish geographer, G. Mercator, appeared as the first among many northern writers worthy of respect who refused to see in the story told by Nicolo Zeno anything more than a clever forgery. One of the latest, and probably the most formidable, of these detractors, was Admiral Zahrtmann, late Hydrographer to the Danish Admiralty. As an experienced seaman, an accomplished geographer, and a Dane well versed in the maritime history of the Danish Colonies with which he had long been intimately acquainted, he was eminently qualified to judge of the accuracy of a narrative, which professed to describe a voyage among islands and to regions, which the friends and foes of Zeno are alike agreed in believing we must recognise as the Faroe Isles, Iceland, and the eastern shores of Greenland. The substance of his careful analysis of the Zeni narrative, and of the map which accompanied it, was communicated in 1836 to the London Geographical Society, in the fifth volume of whose *Journal* it was subsequently published. And there is no doubt that notwithstanding the evidence that had been advanced in favour of the Zeni voyages by Hakluyt in 1600, and still more emphatically a century ago by Capt. Cook's companion, George Forster, English geographers allowed themselves to be powerfully influenced by the opinions of Zahrtmann. In our day, however, the tide of public favour has changed both abroad and in England. And in addition to the uncompromising testimony to the *bonâ fide* character and the general accuracy of the Zeno story, borne by Mr. R. H. Major in his edition for the Hakluyt Society, in 1873, of the "Voyages of the Zeni," and by M. G. Gravier in his "Découverte de l'Amérique par les Normands au 10ème Siècle," 1874, there is now the all-powerful evidence of Baron von Nordenskjöld to be adduced as corroborative, and seemingly conclusive, proof of the genuineness of this mysterious, and long-questioned story of early Venetian adventure in the northern seas.

While engaged in drawing up a history of north-eastern exploration for his "Voyage of the *Vega*," Nordenskjöld's attention was directed to the story of the Zeni voyages, of which he gives a Swedish translation in the number before us of the *Studier och Forskningar*, together with the result of his analysis of the narrative, and his comparison of the Zeno map with all the printed and manuscript maps known at the time of Marcolini's publication in 1558 Among the numerous interesting conclusions at which he has arrived, special attention is due to the following:—(1) That the general accuracy of the descriptions, for which there was no other known source, proves that the Zeni brothers must have been personally acquainted with the Faroe group and the other islands described in the narrative, as well as with the eastern shores of Greenland; and (2) that, considering the nature of the details given of the mode of life followed by the savages in regions lying in the north-west of the Atlantic, which are now known to us as Newfoundland, Canada, and the United States, but of which Europeans had no correct information until the colonisation of those lands in the seventeenth and eighteenth centuries, there is every reason to believe that the Venetian travellers conversed, as they assert, with persons who had visited these districts of the New World. Further, Baron von Nordenskjöld is of opinion that in the descriptions given by the Zeni's informants of the civilised communities, which they met with during their prolonged wanderings in these unknown western lands, we have evidence of the influence and persistence up to the close of the fourteenth century, when the Zeni are assumed to have been in the north, of the earlier Scandinavian colonies, which undoubtedly existed in the New World in the tenth and eleventh centuries.

The author shows that in the middle of the sixteenth century there were three maps in use, of the north and of the north-west, which, in addition to the Zeno map, had all been derived from northern sources, preceding the date of the discovery of America by Columbus. Of these the most important is a manuscript map, with descriptions of Northern Europe and of neighbouring lands, bearing the date of 1427, on which the Scandinavian countries are for the first time set down with anything like accuracy, and a considerable part of America is delineated. Our knowledge of this important pre-Columbian chart is entirely due to Baron von Nordenskjöld, who discovered it in a manuscript copy of Ptolemy's "Cosmographia," preserved in the Town Library of Nancy, of which he was permitted to make a facsimile, and to give a photographic copy in his *Studier och Forskningar*.

The value of this curious record of the geographical knowledge possessed in the early part of the fifteenth century of Scandinavia, and the adjoining seas, is increased by the fact that the map was laid down by a native of the Danish Island of Fyen, known as Claudius Clavus, or Cimbricus, who undertook the task for and

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[1] "Studier och Forskningar, Föranledda af Mina Resor i Höga Norden; Ett Populärt Vetenskapligt Bihang til Vegas Färd kring Asien og Europa." A. E. Nordenskjöld. Häft 1. (Stockholm, 1883.)